THE PLANETARY DATA SYSTEM MARS EXPLORER. E. M. Eliason, P. Garcia, and D. R. Larsen, *U. S. Geological Survey, 2255 North Gemini Drive, Flagstaff AZ 86001 (eeliason@usgs.gov).*

Introduction

The recent discovery that life may have once existed on Mars has generated renewed interest in the exploration of the planet. The recent launches of Mars Pathfinder and Mars Global Surveyor are but the beginning of a series of planned NASA-sponsored exploration missions that will hopefully resolve the question of life on the planet. As a result of this new interest, there has been an increased demand for services that provide easy access to data from past Mars missions. The Planetary Data System (PDS), curator for NASA's planetary mission data, is developing World Wide Web services that greatly improve data accessibility for planetary scientists as well as the general public. These services include the Mars Explorer, discussed in this abstract, the International Mars Data Base (IMDB) [1], and the Mars Navigator.

The Mars Explorer is a web service giving investigators the ability to produce tailor-made image maps of any area of Mars at a variety of map sizes and scales. The Mars Explorer uses the Mosaicked Digital Image Models (MDIMs) [2] containing both color and higher resolution black-and-white datasets . The Mars Explorer uses a simple "point-and-click" approach for defining an image map or alternatively a user can enter the latitude and longitude coordinates of the map. The map scale can be defined so that either regional low-resolution or high-resolution maps can be generated. Once an image map is produced by the Mars Explorer, the map is transmitted to the user's web browser screen for viewing. Optionally, the generated map can be downloaded to a file on the user's system for later use. The Mars Explorer can be accessed by connecting your web browser (such as Netscape, Internet Explorer, or NSCA Mosaic) to the web site at PDS Imaging Node: (*http://www-pdsimage.wr.usgs.gov/PDS/public/mapmaker/mapmkr.htm*).

Database for Mars Explorer

The MDIMs of Mars, compiled by the U.S. Geological Survey and released through the PDS Imaging Node, provide the database for the Mars Explorer. The MDIMs are the result of an exhaustive Mars cartography project based on data from the Viking Orbiter missions. The MDIMs are comprised of mosaics of digital images that have undergone radiometric, geometric, and photometric rectification providing a uniform cartographic portrayal of a planetary surface mapped in the Sinusoidal Equal-Area projection. The MDIMs are organized on a 14 CD-ROM volume set containing a black-and-white medium-resolution MDIM (volumes 1-6), a low-resolution digital terrain model (DTM) (volume 7), and three-color low-resolution MDIMs of multiple color-sequence observations of the planet (volumes 7-14). Although the DTM is available on the CD-ROM volume set, these data are not currently used by the Mars Explorer.

The medium-resolution MDIM has a resolution of 1/256°/pixel (231 meters/pixel on Mars). If presented as a single file the MDIM would constitute an eight-bit single image of 92,106 samples by 46,080 lines (approximately 4 gigabytes) in cylindrical geometry, far too cumbersome for most users to use as a single file. The MDIM has therefore been formatted in 1964 sub-areas, or "tiles" with nominal dimensions of 5° latitude by 5° longitude in the equatorial region of the planet. The low-resolution three-color MDIMs (violet, green, and red filter data from Viking Orbiter cameras) have a resolution of 1/64°/pixel (920 meters/pixel) and are formatted in tiles of dimension 15° by 15° at the equator. Each CD-ROM volume also contains reduced resolution (1/4° to 1/16°/pixel) MDIMs providing regional views of the planet. For maximum efficiency, Mars Explorer makes use of the reduced resolution MDIMs when a user requests a low resolution map.

With the MDIMs organized in a tiling scheme and stored across fourteen CD-ROM volumes investigators often have difficulty utilizing the data. An additional problem exists when an area of interest crosses several tiles making it difficult to view. The Mars Explorer system simplifies the use of the MDIMs by making tailored maps according to a user's specifications, thus hiding the complexity of the database.

How Mars Explorer Works

The Mars Explorer is comprised of two functional components: 1) a web-server system that handles the communications and linkages to a user's web browser, and 2) map generation software, known as MapMaker, for creating tailored maps according to a user's specifications.

When a user links to the home page of the Mars Explorer a low-resolution global map of the planet, sized to fit within a computer screen, is displayed in the user's web browser window. The user defines an image map to be produced by moving the display cursor to the desired area on the map and clicking the mouse button. Optionally the user may enter the center latitude and longitude coordinate of the desired map and then click on the submit button. The coordinate information is then passed to the MapMaker application for creation of the image map.

MapMaker locates and reads the tiles stored on the CD-ROM jukebox needed to construct the desired image map, scales the tiles to match the desired resolution, and "knits" the tiles together to form a single image map. The results are then transmitted to the user's web browser. The generated map is produced "on-the-fly" with little wait time for the user.

A “results page” is returned to the user’s web browser allowing the user to view the image map and optionally download it to a JPEG-formatted image file. Additionally, the user may create another image map by using the pan, zoom, map-projection, dataset, and image-size buttons located on the results page. The pan buttons adjust the center location of the map. The zoom buttons change the map scale

ranging from 1/8°/pixel to 1/256°/pixel. The map-projection button allows a user to select among the Mercator, Simple-Cylindrical, and Sinusoidal Equal-Area projections. The dataset button selects black-and-white or color image maps. The image-size button allows a user to create large (1024 x 1024 pixels) to very small images (128 x 128).

Summary

The Mars Explorer has proven to be a successful World Wide Web resource for science investigators as well as the general public. Remote sensing scientists can produce both black-and-white and three-color image maps of any area of the planet at scales ranging from 1/8°/pixel (7.38 kilometers/pixel) to 1/256°/pixel (231 meters/pixel) centered over their research area. The simple "point-and-click" interface for defining image maps also makes the service popular to the general public. Approximately 25,000 image maps are produced each month by the Mars Explorer.

The Mars Explorer will soon incorporate the new highest resolution MDIM datasets available for the planet. These data sets, covering approximately 20% of the surface, have resolutions that range from 1/1024°/pixel (57 meters/pixel) to 1/4096°/pixel (14 meters/pixel).

Additionally, Mars Explorer will be modified to handle other global-wide planetary collections including the Magellan F-Map dataset of Venus and the Clementine DIMs of the Moon.

References: [1]Slavney, S., Arvidson, R.E., Eliason, E., Duxbury, E., and LaVoie, S., 1997, The International Mars Data Base, *This Issue.* [2]Batson, R.M., and Eliason, E.M., 1995, Digital Maps of Mars, *Photometric Engineering and Remote Sensing*, Vol. 61, No. 12.